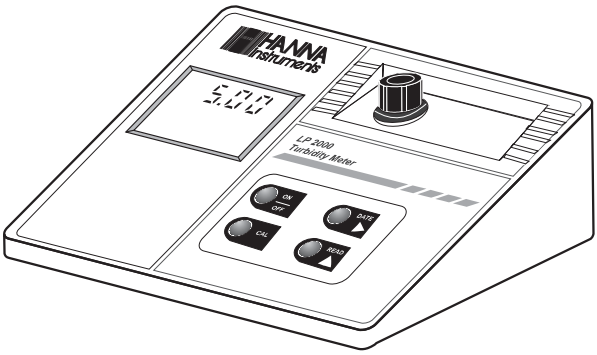
Instruction Manual

LP 2000
Microprocessor-based Bench Turbidity Meter



HANNA instruments
www.hannainst.com

CE
This Instrument is in Compliance with the CE Directives

Dear Customer,

Thank you for choosing a Hanna Product. Please read this instruction manual carefully before using the instrument. It will provide you with the necessary information for the correct use of the instrument, as well as a precise idea of its versatility.

This instrument is in compliance with CE directives.

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PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it to make sure that no damage has occurred during shipping. If there is any damage, notify your dealer immediately.

LP 2000 is supplied complete with:

- Measurement cuvette and cap
- **HI 93703-0** AMCO-EPA-1 calibration solution @0 FTU (30 mL)
- **HI 93703-10** AMCO-EPA-1 calibration solution @10 FTU (30 mL)
- 12VDC Transformer (**HI 710005** or **HI 710006**)

Note: Save all packing material until you are sure that the instrument functions correctly. Any damaged or defective item must be returned in its original packaging with the supplied accessories.

GENERAL DESCRIPTION

LP 2000 is a bench microprocessor-based meter used to determine the turbidity of water and wastewater. The meter covers the 0 to 1000 FTU* range with 0.01 resolution from 0.00 to 50.00 FTU* and in single digits from 50 to 1000 FTU*. It also auto-ranges between the two scales.

Note: LP 2000 has been designed according to the ISO 7027 International Standard. The turbidity measurement unit is FTU (Formazine Turbidity Unit), which is identical to NTU (Nephelometric Turbidity Unit).

LP 2000 carries the CE mark, in compliance with the European directives, ensuring low emission values and accurate measurements in presence of electromagnetic fields.

The meter is housed in a rugged and lightweight case, with an easy-to-read LCD.

The meter is simple to use. All operations can be carried out with only four keys and troubleshooting functions can be performed with error codes on the display. An exclusive positive-locking system guarantees that the cuvette is firmly placed in the cell. The keypad is water-resistant and can be wiped clean.

Calibration at 10 FTU* can be easily performed using the supplied standard. In addition, **LP 2000** is the first bench turbidity meter that allows the storage and retrieval of the last calibration date.

10 FTU* was chosen as the calibration point because its value best fits the water turbidity measurements in a wide range of applications, from drinking water to wastewater treatment.

* 1 FTU = 1 NTU

UNITS OF MEASURE

Hanna Instruments uses the primary standard AMCO-AEPA-1 to avoid all formazine-related problems. Formazine is a toxic, unstable substance, which requires particular care. Calibration requiring formazine standards must be preformed immediately after preparation of the standards. Formazine standards may not be reused because of their short life. **LP 2000** standards are extremely stable and have a shelf life of up to six months. Uncontaminated standards may be reused. **LP 2000** can be used with both AMCO-AEPA and formazine standards.

FTU is equal to the NTU. However, other known measurements include: Jackson Turbidity Unit or JTU (based on the old method of Jackson's candle), and Silica Unit in mg/L of SiO_2. See the conversion table below for these units:

	JTU	FTU/NTU	SiO_2 (mg/L)
JTU	1	19	2.5
FTU/NTU	0.053	1	0.13
SiO_2 (mg/L)	0.4	7.5	1

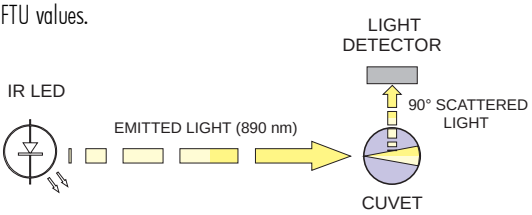
PRINCIPLE OF OPERATION

LP 2000 has been designed to perform measurements according to the ISO 7027 International Standards.

The instrument functions by passing a beam of infrared light through a vial containing the sample being measured.

The light source is a High Emission Infrared LED with a wavelength peaking at 890 nm, which reduces interference caused by colored samples to a minimum.

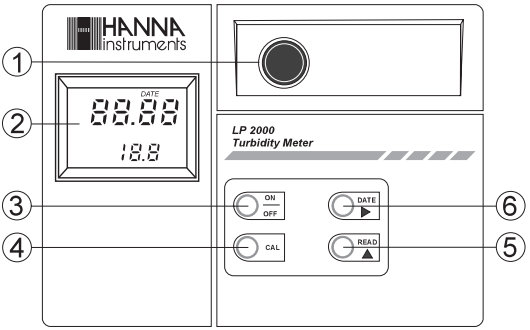
A sensor, positioned at 90° with respect to the direction of light, detects the amount of light scattered by the undissolved particles present in the sample. The microprocessor converts such readings into FTU values.



* 1 FTU = 1 NTU

FUNCTIONAL DESCRIPTION

FRONT PANEL



1) Cuvette Holder
2) Dual Level Liquid Crystal Display
3) ON/OFF
4) CAL, to enter the Calibration Mode
5) READ/▲, to perform measurements and to set the day and month of the last calibration
6) DATE/▶, to display the last calibration date and to select the month or the day of the last calibration

REAR PANEL

i) Power Socket 12V to 20V DC

SPECIFICATIONS

	LP 2000
Range	0.00 to 50.00 FTU* 50 to 1000 FTU*
Resolution	0.01 / 1 FTU*
Accuracy (@ 20°C/68°F)	±0.5 FTU* or ±5% (whichever greater)
Typical EMC Deviation	0.2 FTU*
Light Source	High Emission Infrared LED
Light Source Life	Life of the instrument
Light Detector	Silicon Photocell
Power Source	12VDC through HI 710005 or HI 710006
Environment	0 to 50°C (32 to 122°F); max. RH 95% non-condensing
Dimensions	230 x 170 x 70 mm (9.1 x 6.7 x 2.7")
Weight	600 g (1.3 lb.)

* 1 FTU = 1 NTU

OPERATIONAL GUIDE

POWER CONNECTION

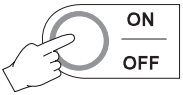
Plug the 12VDC adapter (**HI 710005** - 110VDC, or **HI 710006** - 220VDC) into the DC socket (see page 5).

Plug the adapter into the outlet.

Note: Insure the main line is surge protected.

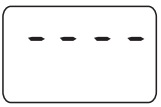
Note: Always turn the meter off before unplugging it to insure no data is lost.

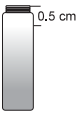
MEASUREMENT PROCEDURE



- Turn the meter on by pressing ON/OFF.

- The meter will first perform an LCD self diagnostic test by displaying a full set of figures. It will then switch to the measurement mode.
- When the LCD displays "----", the meter is ready.

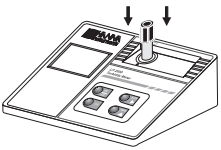




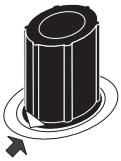
- Fill a clean cuvette up to one quarter inch (0.5 cm) from its rim with the thoroughly agitated sample.
- Allow sufficient time for bubbles to escape before securing the cap.

Note: Do not overtighten the cap.

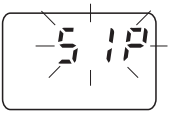
- Wipe the cuvette thoroughly with a lint-free tissue (**HI 93703-70**) before inserting the cuvette into the measurement cell. The cuvette must be completely free of finger marks, oil or dirt, especially in the area where the light passes through, i.e. approximately the bottom 2 cm (3/4" inch) of the cuvette.
- Place the cuvette into the holder and check that the notch on the cap is positioned securely into the groove.



- The mark on the cuvette cap should point towards the keyboard.



- Press the READ/▲ key and the LCD will display an intermittent "SIP" (Sampling In Process).



- The turbidity value will appear after approximately half a minute.

- Though **LP 2000** covers a wide turbidity range, highly accurate readings exceeding 40 FTU require dilution as recommended by the Standard Methods.

  Use the formula below to calculate the amount of **HI 93703-0** or turbidity-free water needed for accurate dilution.
  The total volume = 100 mL.

Vos = 3000 / T

where:

Vos = volume of original sample (mL) to be added to HI 93703-0 to obtain the total diluted volume of 100 mL.

T = LP 2000 reading (exceeding 40 FTU)

E.g.: LP 2000 reading = 200 FTU
3000 / 200 = 15 mL (Vos)
15 mL (Vos) + 85 mL (HI 93703-0) = 100 mL

At this point, take a sample of this diluted solution and measure its turbidity.

The correct turbidity value of the original sample is derived by:

Ta = Tn x 100 mL / Vos

where:

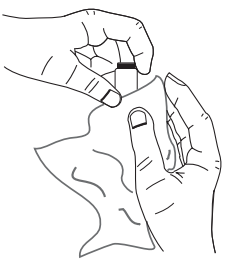
T_o = actual turbidity value of the original sample

T_n = LP 2000 reading of the diluted solution

E.g. If $T_n = 27$
$T_o = 27 \times 100\ mL / 15\ mL = 180\ FTU$

TIPS TO OBTAIN BEST ACCURACY

- Each time the cuvette is used, tighten the cap to the same degree.
- Discard the sample immediately after the reading is taken to prevent permanent clouding of the glass.
- All glassware used to contain the standards and the samples should be kept clean, washed with **HI 93703-50** cleaning solution and rinsed with **HI 93703-0** or turbidity-free water.
- Samples should be collected in clean glass or plastic bottles with appropriate stoppers. Analysis should be performed shortly after. If the sample requires storage, it should be kept in a cool dark place. Stored samples should be restored to room temperature prior to analysis. Samples may not be stored for longer than 24 hours.
- To obtain a representative sample, gently and thoroughly, stir the solution. To prevent air bubbles from forming do not shake or let the solution settle prior to sampling.
- Monthly calibration of the meter, using **HI 93703-10** @ 10 FTU standard is recommended.
- Before inserting cuvettes into the instrument, wipe them with **HI 93703-70** or a soft, lint-free tissue. Handle vials so that no fingerprints are left on the areas where light passes through, i.e. the bottom 2 cm (3/4") of the cuvette.



If you experience any problems in taking measurements, please contact your dealer or the nearest Hanna Customer Service Department.

SOURCES OF INTERFERENCE

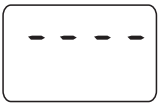
- The presence of floating debris and coarse sediments which may settle rapidly will give false readings.
- The infrared light source of **LP 2000** can effectively minimize errors due to colored substances found dissolved in solution. This "True Color" effect is the most common interference found in commercial instruments operating in the visible light range.
- Air bubbles and the effect of vibrations that disturb the surface of the sample may produce false results.
- Dirty, scratched, or etched glassware will also affect readings.

CALIBRATION

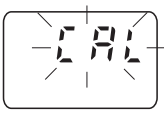
Calibration is recommended at least once a month. You can verify the instrument calibration by comparing the display reading against the supplied standard solution at 10 FTU. To check the date of the last calibration, simply hold the DATE/▶ key down for a few seconds.

CALIBRATION PROCEDURE

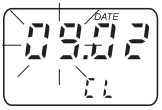
- Turn the meter on and wait for the display to show "----".



- Press the CAL key once. "CAL" will blink on the display for approx. 6 seconds, allowing for confirmation.

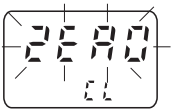


- While "CAL" is still blinking, press CAL again (otherwise, it exits this mode). "CL" will appear on the lower part of the display.

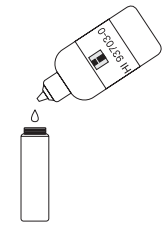


- The date of calibration may now be edited by simply pressing the DATE/▶ key. The default parameter, which is the month segment found on the left, will blink. To scroll to the correct number, press the READ/▲ key. To toggle between month and the day display segments, press the DATE/▶ key. The day segment can also be edited with the READ/▲ key.

- To confirm the displayed values and to proceed, press CAL once more. An intermittent "ZERO" will appear on the LCD.

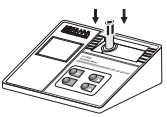


- Using the **HI 93703-0** bottle containing the ZERO FTU Standard (or turbidity-free water), fill the measurement cuvette and secure the cap.

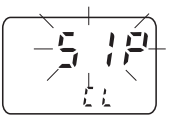


Note: To minimize error caused by the cuvette, it is recommended to use the same cuvette for calibration and measurement.

- Insert cuvette into the holder.

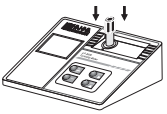


- Press CAL. An intermittent "SIP" indicates that the instrument is being calibrated.

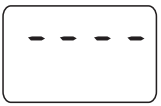


- After approximately 1 minute, the instrument will ask for the **HI 93703-10** standard solution @ 10 FTU by displaying "10.0".

- Refill the cuvette with the **HI 93703-10** AMCO-AEPA-1 standard at 10 FTU and place it into the measurement cell



- Press CAL again. After approximately 1 minute the LCD will display "----".

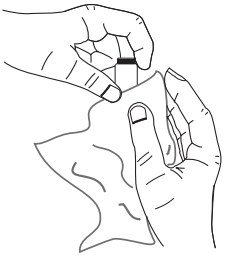


The instrument is now calibrated and ready for use.

TIPS TO OBTAIN ACCURATE CALIBRATION

- All glassware that comes into contact with standards should be kept clean. Wash with **HI 93703-50** cleaning solution and rinse with **HI 93703-0** or turbidity free water.
- Rinse the cuvette twice with 5 mL of the liquid to be tested. This removes any previous liquid and any dust or foreign matter that may be present. Gently pour the liquid down the side of the vial to reduce air bubbles (no mixing is required when **HI 93703-0** and **HI 93703-10** AMCO-AEPA-1 standards are used).

- Before inserting the vial into the instrument, wipe it clean with **HI 93703-70** or a soft, lint-free tissue. Handle vials so that no fingerprints are left on the areas where light passes through, that is the bottom 2 cm (3/4").



STANDARD SUSPENSION

Presently, there are only two recognized primary standards: AMCO-AEPA-1 (available through Hanna) and formazine. **LP 2000** works with both solutions.

AMCO-AEPA-1 has a much longer shelf life at all concentrations (approximately six months, if free from contamination). In addition, no special handling or disposal is required and a much higher stability of suspended particles has been observed.

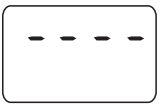
Formazine is highly toxic and is generated by a known carcinogen, with poor stability (particles settle quickly). Lower concentrations change value quickly after dilution.

The consistency of **LP 2000** readings by using both standards has been separately established by Advanced Polymer Systems and Hanna Instruments.

Additional documentation about the formazine standard and other calibration procedures is available upon request.

VIEWING THE CALIBRATION DATE

- Turn the meter on and wait for the display to show "----".

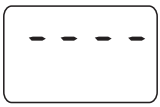


- Press and hold the DATE/▶ key. The month and day of last calibration ("MM.DD") appear while the key is held down.

Note: The displayed date is the date that was input by the user at the beginning of the last calibration.

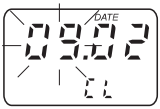
LCD AND ERROR CODES

LP 2000 displays several different LCD codes to help the user to operate the meter more efficiently.

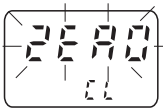


This indicates that the meter is in a ready state and measurement or calibration can be performed.

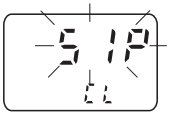
This indicates that the Calibration Mode is active. If the CAL key is not pressed within 6 seconds, the meter will automatically revert back to the Measurement Mode.



This indicates that the Calibration Date Setting Mode is active.

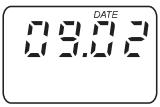


This indicates that a 0 FTU standard calibration solution is required.

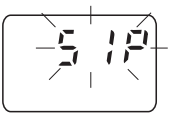


This indicates that the instrument is being calibrated at zero.

This indicates that a 10 FTU standard calibration solution is required.



This shows the last calibration date (MM.DD).



This indicates that the sample is being analyzed.

This indicates that an error occurred during calibration (for example a wrong standard was used). Repeat the calibration with fresh standards.

ACCESSORIES

HI 710005	110VDC voltage transformer
HI 710006	220VDC voltage transformer
HI 731318	Tissue for wiping the cuvettes (4pcs)
HI 731321	Glass measurement cuvettes (4pcs)
HI 731325	Cap for cuvette (4pcs)
HI 93703-0	Solution for calibration AMCO-AEPA-1 at 0 FTU, 30 mL
HI 93703-10	Solution for calibration AMCO-AEPA-1 at 10 FTU, 30 mL
HI 93703-50	Cuvette cleaning solution, 230 mL

WARRANTY

All Hanna Instruments **meters are warranted for two years** against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. This warranty is limited to repair or replacement free of charge.

Damage due to accident, misuse, tampering or lack of prescribed maintenance are not covered.

If service is required, contact the dealer from whom you purchased the instrument. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization number from the Customer Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

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Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.

CE DECLARATION OF CONFORMITY

HANNA instruments

CE

DECLARATION OF CONFORMITY

We

Hanna Instruments Italia Srl
via E.Fermi, 10
35030 Sarmeola di Rubano - PD
ITALY

herewith certify that the turbidity and ion specific meter

LP 2000

has been tested and found to be in compliance with EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC according to the following applicable normatives:

EN 50082-1: Electromagnetic Compatibility - Generic Immunity Standard
IEC 801-2 Electrostatic Discharge
IEC 801-3 RF Radiated
IEC 801-4 Fast Transient

EN 50081-1: Electromagnetic Compatibility - Generic Emission Standard
EN 55022 Radiated, Class B

EN61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use

Date of Issue: 6-10-1998

P. Cesa - Technical Director
On behalf of
Hanna Instruments S.r.l.

Recommendations for Users

Before using this product, make sure that it is entirely suitable for the environment in which it is used.

Operation of this instrument in residential area could cause unacceptable interferences to radio and TV equipments, requiring the operator to take all necessary steps to correct interferences.

Any variation introduced by the user to the supplied equipment may degrade the instrument's EMC performance.

To avoid electrical shock, do not use this instrument when voltages at the measurement surface exceed 24VAC or 60VDC.

To avoid injury or damage to the meter, do not perform any measurement in microwave ovens.

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